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(54) Radio infrastructure network

(57) A radio infrastructure network has asynchronous transfer mode (ATM) networks 28 in which data is transmitted in fixed size packets (cells) and has one network 8 which interconnects base stations 16 which communicate by r.f. signals to mobile users 20 and wherein data transmission across a base station interface 14 and a mobile station interface 22 is of data contained in only one equal length subdivided section (preferably half) of each cell. A conversion 12 is made at an interface between a fixed telecommunications ATM network 2 and the ATM network 8 which interconnects base stations, the conversion is made between standard ATM cells in the telecommunications infrastructure and half ATM cells in the network which interconnects base station. However, the half ATM cells would be filled out with some additional signalling and routing information in order to resemble and behave like ordinary full ATM cells. A buffer store and rate converter may be used. The hardware in the base station interconnect network can be of the same type as that used in the fixed telecommunications network.

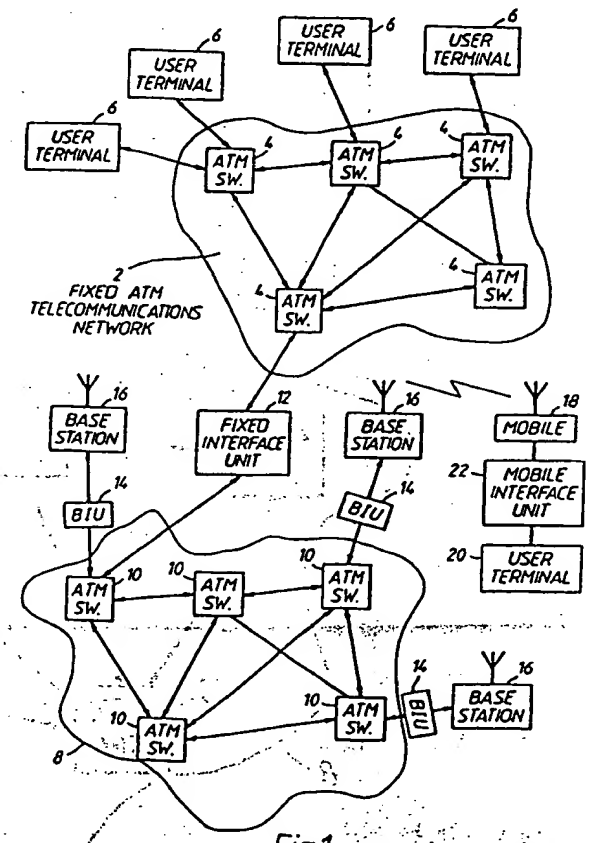
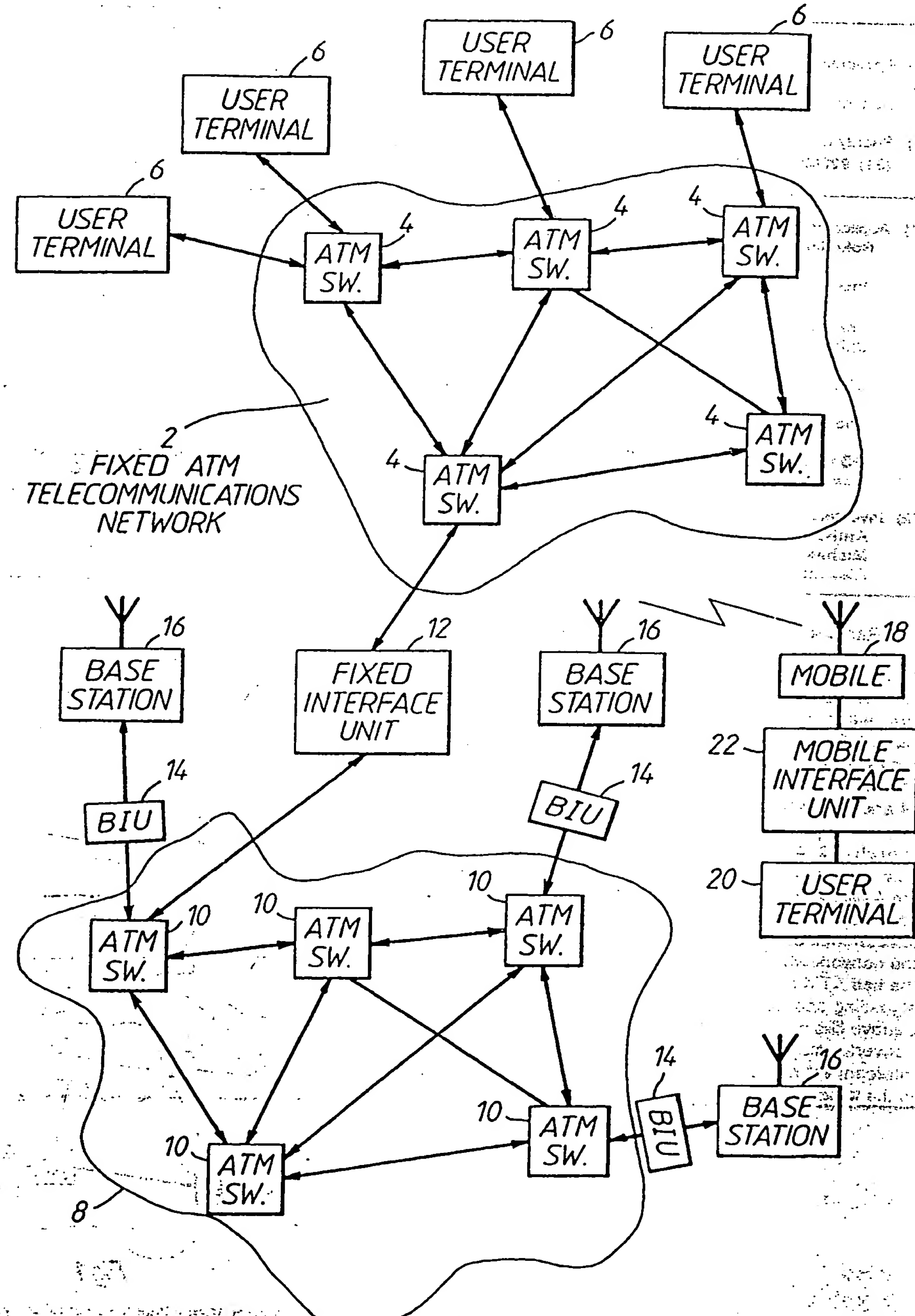


Fig.1.

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

This print incorporates corrections made under Section 117(1) of the Patents Act 1977.

GB 2 265 278 A



USER TERMINAL
6
ATM SW.
4
2
FIXED ATM TELECOMMUNICATIONS NETWORK
BASE STATION
16
FIXED INTERFACE UNIT
12
MOBILE
18
22
MOBILE INTERFACE UNIT
20
BIU
14
10
8

Fig.1.

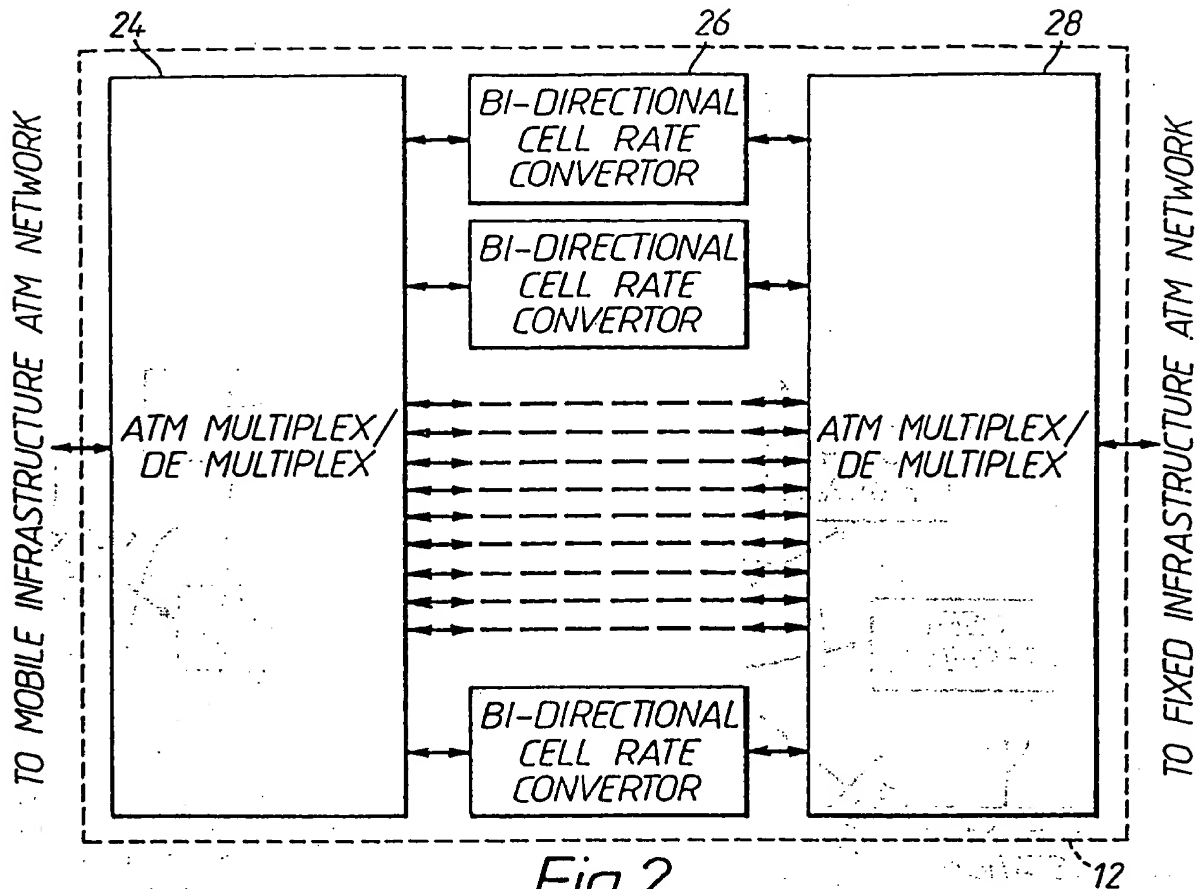

24
26
28
BI-DIRECTIONAL CELL RATE CONVERTOR
BI-DIRECTIONAL CELL RATE CONVERTOR
BI-DIRECTIONAL CELL RATE CONVERTOR
ATM MULTIPLEX/ DE MULTIPLEX
ATM MULTIPLEX/ DE MULTIPLEX
TO MOBILE INFRASTRUCTURE ATM NETWORK
TO FIXED INFRASTRUCTURE ATM NETWORK
12

Fig.2.

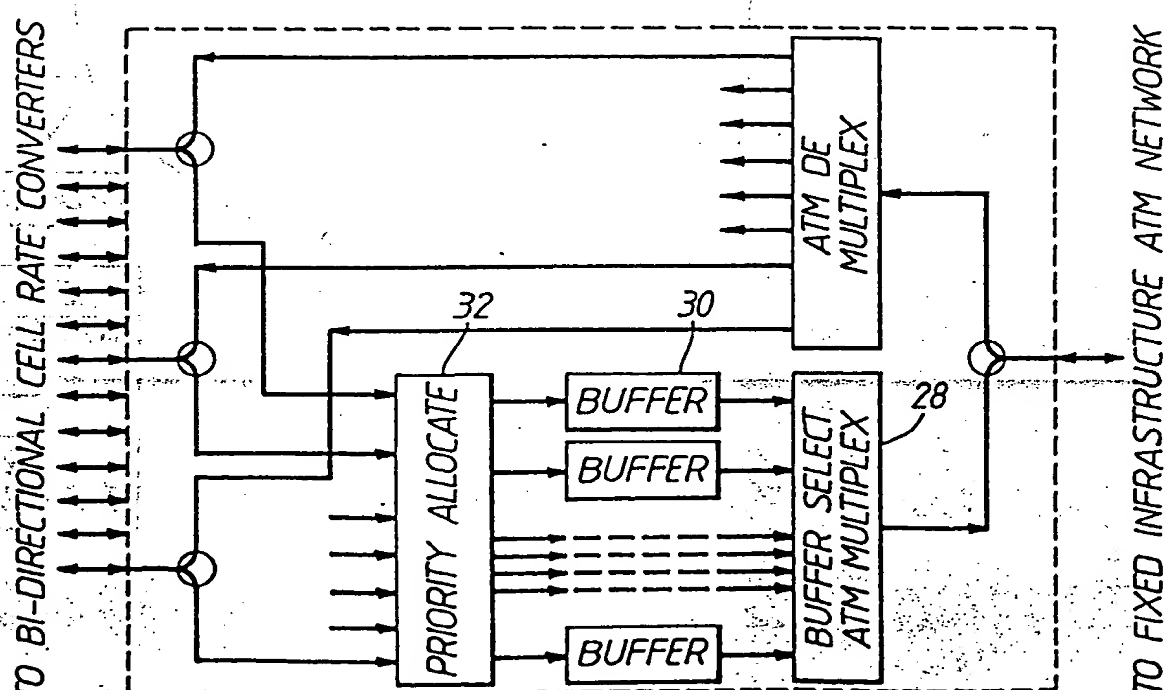

TO BI-DIRECTIONAL CELL RATE CONVERTERS
ATM DE MULTIPLEX
32
30
PRIORITY ALLOCATE
BUFFER
BUFFER
BUFFER
BUFFER SELECT ATM MULTIPLEX
28
TO FIXED INFRASTRUCTURE ATM NETWORK

Fig.3.

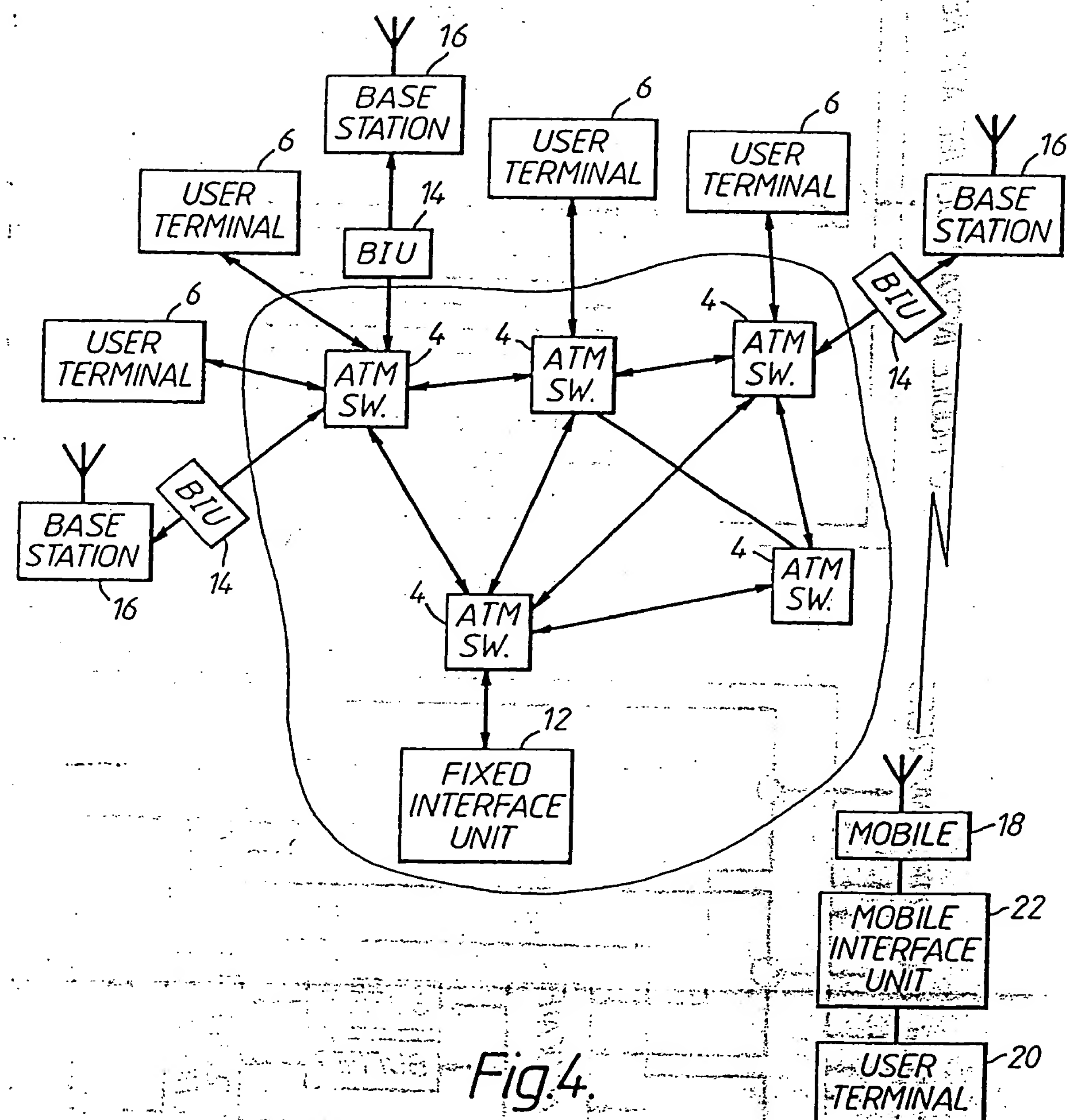

16
BASE STATION
6
USER TERMINAL
6
USER TERMINAL
6
USER TERMINAL
14
BIU
6
USER TERMINAL
16
BASE STATION
BIU
14
4
ATM SW.
4
ATM SW.
4
ATM SW.
BIU
14
BASE STATION
16
4
ATM SW.
4
ATM SW.
12
FIXED INTERFACE UNIT
MOBILE
18
MOBILE INTERFACE UNIT
22
USER TERMINAL
20

Fig.4.

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RADIO INFRASTRUCTURE NETWORK

The present invention relates to radio infrastructure networks and in particular to those networks which use asynchronous transfer mode cell transmission, which may be used in telecommunications systems.

Telecommunications systems are likely to involve growth in two main areas, namely flexible wideband service capability for cable connected users, and the provision of a large subset of services to mobile users. The flexible wideband service capability may be served by asynchronous transfer mode (ATM) networks to provide an integrated broadband communications network (IBC). This provides flexible data rates up to high peak rates by sub-dividing the data for transmission over the network into small, fixed size packets called cells. The cells consist of 48 bytes of user data in addition to 5 bytes of control information making a total of 53 bytes per cell. ATM networks can support many different services based upon this fundamental transport mechanism. The control information includes identity and routing information which permits transport of the cell from source to destination between intermediate switches along a route set up at the time a call is established.

The extension of some of the higher data rate services to the mobile user requires highly spectral efficient radio technology, such as code division multiple access (CDMA). This allows many users to share the same RF spectrum simultaneously through the use of spread spectrum. The interference environment for reception of any particular user transmission is the sum of the transmission from all

of the users. This is a particularly attractive feature because it provides a measure of decoupling between the total interference level and the activity of individual users. It allows small bursts of data to be transmitted with negligible notice of call set up arbitration, and this feature would be well matched to the flexible responsive transmission of ATM cells in the cable connected network.

An aim of the present invention is to merge the radio interface with the ATM in the fixed infrastructure.

According to the present invention there is provided a radio infrastructure network comprising at least one ATM telecommunications network in which the data to be transmitted is divided into fixed sized packets (cells), characterised in that the ATM telecommunications network is connected to a plurality of user terminals, and to a plurality of base stations by way of respective base station interface units, the base stations communicating by use of radio frequency signals to mobile user terminals, each mobile user terminal being connected to a mobile interface unit, each cell is divided into a plurality of equal length sections and the transmission of data across the base station interface units and the mobile interface units is comprised of data contained in only one of the sections of each cell.

According to a feature of the invention, each cell may be split into two equal lengths and the user data is transported from one half of each ATM cell in individual transmission logical bursts.

An embodiment of the present invention will now be described with reference to the accompanying drawings, in which;

FIGURE 1 shows a radio infrastructure network including an ATM mobile interface;

FIGURE 2 shows a fixed interface unit;

FIGURE 3 shows a queuing function associated with the fixed interface unit; and

FIGURE 4 shows a further radio infrastructure network.

Referring to Figure 1, the radio infrastructure network shown comprises a fixed ATM telecommunications network 2, which includes a plurality of ATM switches 4, interconnected so that each ATM switch can directly communicate with an adjacent ATM switch or can communicate indirectly with another ATM switch via an intermediary switch. Some of the ATM switches 4 are shown directly connected to user terminals 6.

A network 8, similar to the network 2, is shown which similarly comprises a plurality of ATM switches 10, interconnected in a similar manner to the network 2. The network 2 and the network 8 are connected together via a fixed interface unit 12. The fixed interface unit 12 directly connects one of the ATM switches 10 in the network 8 to one of the ATM switches 4 in the network 2. Some of the ATM switches 10 in the network 8 are connected via base interface units 14 to respective base stations 16. The base stations 16 are radio base stations and communicate over an air interface by use of radio signals to a mobile transceiver 18, which is connected to a mobile user terminal 20 by way of a mobile interface unit 22.

In Figure 1, the fixed interface unit 12 and the mobile interface unit 22 are very similar, the essential difference being that the fixed

interface unit 12 must perform interfacing for a large number of links, whereas the mobile interface unit 22 is only handling one link.

The mobile interface unit 22 performs the following functions. For data to be transmitted from the mobile transceiver of Figure 1 to the user terminal 20 of Figure 1, the mobile interface unit is arranged to take two half ATM cells from the interface and create one fixed infrastructure type ATM cell for transmission to the user terminal. In the opposite direction of transmission, the mobile interface unit takes one ATM cell from the user terminal and divides it into two halves for transmission over the air interface.

The base station interface unit 14 performs the following function. Prior to describing this unit, it will be appreciated that the half ATM cells in the base station interconnect network would be filled out with some additional signalling and routing information in order to resemble and behave like ordinary full ATM cells. In this way the hardware used in the base station interconnect network could be the same type as that used in the fixed telecommunication network.

The base station interface unit receives data from the base stations 16 and transmits the data to the ATM network 8. In this direction of transmission the base interface unit takes one logical burst of data from the air interface and pads that data out to create an ATM cell for the mobile infrastructure ATM network. In the opposite direction of transmission, the base interface unit takes one ATM cell from the mobile infrastructure ATM network and strips out the redundant information for transmission over the air interface.

Referring to Figure 2, the fixed interface unit will now be described. The fixed interface unit 12 comprises an ATM multiplexer/de-multiplexer 24 which transmits and receives data from the mobile infrastructure ATM network 8 (Figure 1). The ATM multiplexer/de-multiplexer 24 receives and transmits data to a further ATM multiplexer/de-multiplexer 28 by a bi-directional cell rate converters 26. The ATM multiplexer/de-multiplexer 28 transmits and receives data to the fixed infrastructure ATM network 2 (Figure 1).

The fixed interface unit may include a priority queuing arrangement as shown in Figure 3. The queuing arrangement operates on the transmission of data in the direction of data flow from the mobile infrastructure ATM network to the fixed infrastructure ATM network. The queuing arrangement is situated between the bi-directional cell rate converters 26 (Figure 2) and the ATM multiplexer 28 (Figure 2). The queuing arrangement comprises a plurality of buffer stores 30, each being connected to an input line of ATM multiplexer 28. The input to each buffer store 30 is controlled by a priority allocate circuit 32 which receives information from the bidirectional cell rate converters. All the cells relating to an individual call are placed in a particular buffer. Each buffer is allocated a priority by the circuit 32, and the cells from a buffer of higher priority are selected for transmission in preference to cells within a buffer of lower priority.

The function of the bi-directional cell rate converters will now be described. In the direction of transmission from the mobile infrastructure network 8 to the fixed telecommunication network 2

(Figure 1), the converters are arranged to take two ATM cell from the mobile infrastructure ATM network and strip out the redundant information and combine that information to create one ATM cell for the fixed infrastructure ATM network. In the opposite direction of transmission, the converters take one ATM cell from the fixed infrastructure ATM network and split it into two sections. Each section is padded out with redundant information and radio specific routing information to create two ATM cells for the mobile infrastructure ATM network.

The above approach has the advantages of the ability to use standard ATM hardware for the interconnection required in the radio sub-system. Greater benefits can be achieved if the above concept is extended. If the mobile infrastructure ATM network and the fixed infrastructure ATM network are considered as distinct logical entities but constructed from the same physical hardware, the architecture shown in Figure 1 becomes that which is now shown in Figure 4.

In Figure 4, the blocks which are identical to those in Figure 1 have been given the same reference number and function in the same way.

The network shown in Figure 4, functions in the same way as that described with reference to Figure 1, except the same ATM switches 4 may be used for either traffic of the mobile infrastructure type or traffic of the fixed infrastructure type data. Any traffic which must flow between fixed and mobile terminals is automatically routed via the fixed interface unit 12 for cell splitting/merging. Several advantages are obtained by this method, as follows:-

No additional ATM switches are required. Base stations may be connected to ATM switches in much the same way users registered for wideband services.

Processing operations required for interfacing may be grouped together into large multi-linked fixed interface units, thus providing economy of scale and improvements in trunking efficiency.

Different fixed interfaced units could be included with different roles. For example, the transition between voice in the fixed infrastructure network at 64 kbps and in the mobile infrastructure network at, for example, 8 kbps will require transcoding. One type of fixed interface unit could be dedicated to this operation, and a transcoder would be provided for this purpose. Different cell rate converters would be required as follows.

In the direction of transmission from the ATM multiplexer/de-multiplexer mobile infrastructure ATM network side to the ATM multiplexer/de-multiplexer on the fixed infrastructure ATM network side, the converter will take data from one ATM cell in the mobile infrastructure ATM network and remove the padding. The converter will then transcode from 8 kbps to 64 kbps and then take data from the transcoder and construct four ATM cells for the fixed infrastructure. In the reverse direction the converter would collect four ATM cells from the fixed infrastructure and transcode them from 64 kbps to 8 kbps. The data would then be taken from the transcoder and padded out to create one ATM cell for the mobile infrastructure ATM network.

It will readily be appreciated by those skilled in the art that the above description has been of one embodiment and one example

only. While the description is related to half cells it will be appreciated that any sub-multiple of a cell may be taken and used. Also, other specialised cell rate converters may be used to satisfy any requirement. For example, in the case of video telephony some rate conversion may be required.

CLAIMS:

1. A radio infrastructure network comprising at least one ATM telecommunications network in which the data to be transmitted is divided into fixed sized packets (cells), characterised in that the ATM telecommunications network is connected to a plurality of user terminals, and to a plurality of base stations by way of respective base station interface units, the base stations communicating by use of radio frequency signals to mobile user terminals, each mobile user terminal being connected to a mobile interface unit, and wherein each cell is divided into a plurality of equal length sections and the transmission of data across the base station interface units and the mobile interface units is comprised of data contained in only one of the sections of each cell.

2. A radio infrastructure network as claimed in claim 1, wherein one ATM network is a fixed telecommunications network, having a plurality of ATM switches which may be connected to a respective user terminal, and a further ATM telecommunications network, having a plurality of ATM switches which may be connected to a respective base statiòn by way of a respective base interface unit, the fixed ATM telecommunications network and the further ATM telecommunications network being interconnected by way of a fixed interface unit connecting an ATM switch in each respective network.

3. A radio infrastructure network as claimed in claim 1 or claim 2, in which each cell is divided into two equal length sections.

4. A radio infrastructure network as claimed in any preceding claim, wherein the fixed interface unit includes a queuing arrangement which includes buffer storage means in which cells relating to a particular call are stored in a particular buffer store, and to which buffer store an indication of priority is allocated, such that cells are selected for transmission from a buffer store having a higher priority than those with a lower priority.

5. A radio infrastructure network substantially as hereinbefore described with reference to the accompanying drawings.

Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report)

Application number
GB 9213564.9

Relevant Technical fields

(i) UK Cl (Edition K) H4K (KTK, KYR)

(ii) Int Cl (Edition 5) H04B 7/04, 11/04

Search Examiner

G N CHAPMAN

Databases (see over)

(i) UK Patent Office

(ii) ONLINE DATABASES: WPI

Date of Search

22 OCTOBER 1992

Documents considered relevant following a search in respect of claims 1 TO 5

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
A	GB 2249922 A (MATSUSHITA) note page 14 line 27 to page 16 line 16 and figures 1 and 2	

SF2(p) ME - doc99\fil000403

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

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